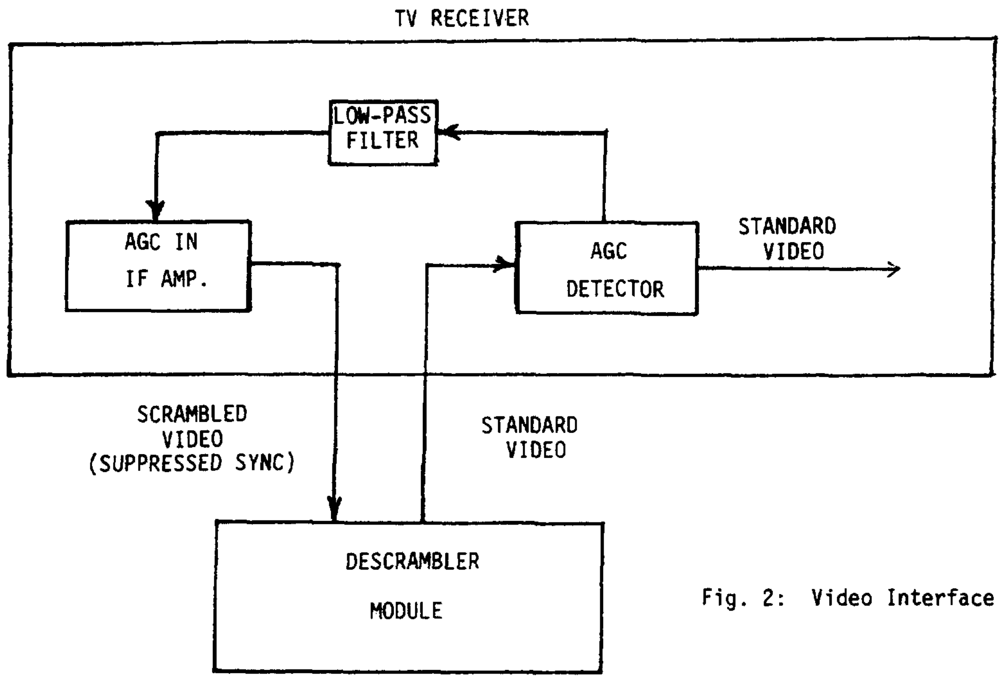

Fig. 2: Video Interface

and video and audio demodulators. This decoder would return baseband video and audio to the TV receiver, using the receiver only for its tuner and monitor functions. An IF loopout of this type has the problem of supplying correct AGC and AFT control signals to the tuner, since the internal IF amplifier will not be operating correctly. The IF loopout does not presently have a consensus going for it.

The Audio Loopout

Although there is presently very little scrambling of audio for pay-TV, cable operators are in agreement that audio scrambling will be an important part of their security in the years to come. There is a consensus that the decoder module should provide for audio descrambling.

Three types of audio connections have been considered: 1) baseband audio in and out, 2) wideband composite audio in and out, and 3) 4.5 MHz audio. The 4.5 MHz output from the TV receiver was intended for sync-suppression descrambler modules, and has been dropped from consideration. Wideband audio, taken ahead of deemphasis, is desirable as an output from the TV because it makes possible descrambling by the module, of audio, scrambled or encrypted through the use of subcarriers on the audio carrier. Good-quality wide-band audio will be readily available in a few years from TV receivers having multi-channel sound. Wide-band audio, ahead of de-emphasis, is not available in many current receivers. Even if it were made available, the intercarrier conversion, as it is done in current receivers, might impair the quality that signal. Wide-band audio, as an input to tne TV receiver, from the module, is probably not needed, as descrambler modules will probably not return composite stereo to the TV receiver when they can simply return right and left audio channels. Baseband audio inputs to the TV set are needed to return this decoded audio as baseband right and left channels. Right and left audio outputs from the TV set are useful because they permit modules, intended for video-only descrambling, to loop the audio back to the right and left inputs, with no additional switching complications. The decoder interface will probably be a multipin connector with automatic jumper switches for the video and audio loopouts.

Cable Loopthrough

Many addressable cable-systems have their address data on a separate carrier, outside of the TV channels. While the TV receiver cannot be expected to demodulate this data channel, the descrambler module can, if it is provided with a loopthrough of the cable. This cable loopthrough would be in addition to the multi-pin interface connector, where desired,and is shown in Fig. 3.

Power

The interface could be defined to include limited power supplied by the TV receiver to the descrambler module. Modules requiring higher power, or needing their out-of-band address receivers maintained continuously, can, of course, be provided with a separate power cord. Descrambler modules, however, lacking the tuners and IF circuits of baseband converters, will consume far less power than our current converter-descramblers. Inclusion of a power pin in the interface would encourage the development of low-power modules within a few years. A concensus does not presently exist for this feature.

From: NCTA 32nd Annual Convention, Technical Papers, Houston, TX; June 12-15 1983.

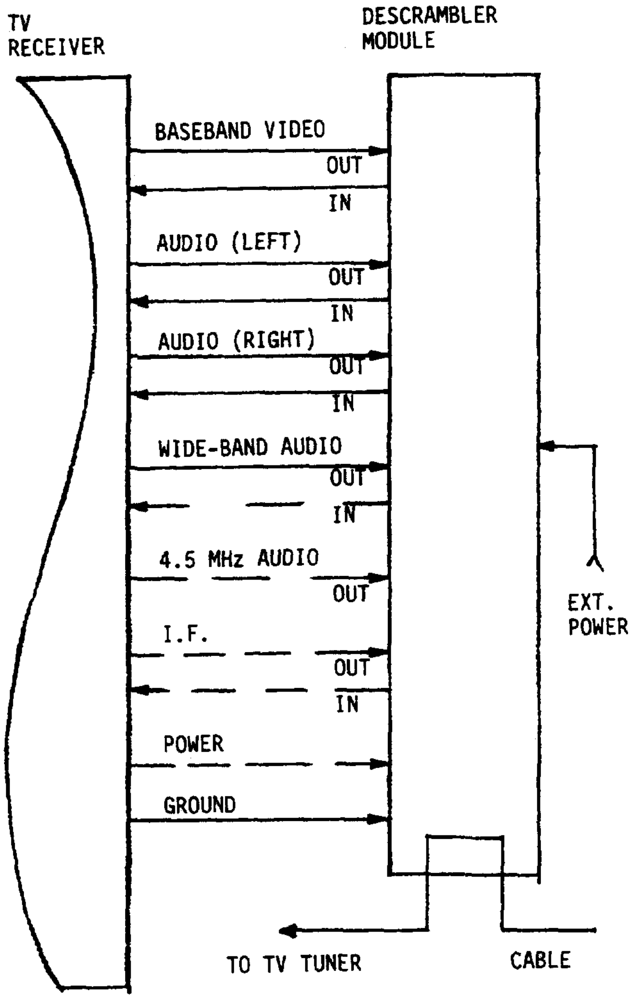

Figure 3: The descrambler module, showing the descrambler interface and other connections.

Conclusion

The problem of compatibility between full-feature TV receivers and cable systems has received considerable attention in the past year. Cable operators have announced a willingness to use the interface when it becomes available. Unsettled questions, of course, remain. Among them is the important question of isolation and safety. While work remains to be done, the progress to date has been very encouraging, and we have reasonable hope of seeing truly cable-compatible TV receivers within a few years.

References

1) E. S. Kohn, "Scrambling and Cable-Ready TV Receivers", IEEE Trans. on Consumer Electronics, CE-28, #3, 220-225, August 1982.

From: NCTA 32nd Annual Convention, Technical Papers, Houston, TX; June 12-15 1983.

APPENDIX B. - HYPOTHETICAL APPLICATION OF THE PROPOSED COMMISSION RULES DURING THE MULTIPORT DEVELOPMENT PERIOD

If the Commission, in 1994 acts in accordance with Paragraph 28 of its NPRM, and allows only three years for full market availability of Decoder Interfaced equipped "cable-ready" equipment, it would be equivalent to the hypothetical situation wherein the Commission would have asserted these proposed rules in mid 1983, when a first outline of a Decoder Interface or a paper design were proposed[37]. Based on the historical facts pertaining to the development of Multiport as described in Appendix A, it is instructive to follow this hypothetical situation to its logical conclusions. We therefore hypothetically assume that in 1983, the Commission would have required that receiving devices sold or imported after mid 1986 as "cable-ready" must have Decoder Interfaces. Referring to Figure 1 in Appendix A, we note that in 1985, during the tests at ATC's lab, it would have been discovered that AGC interface parameters needed modifications. This introduced substantial delays in the "planned" mid 1986 product introduction. No doubt, all parties would have had to come to the Commission and petition for extension of time. Both the consumer electronics and cable industries would have had very persuasive arguments, citing unexpected circumstances that require modifications and revisions in the interface. Elaborate technical exhibits describing the problems and their intended solutions would have been filed along with pledges to finalize the interface as soon as possible. An extension to mid 1987 would have been requested. Would the Commission have granted such request for extension of time? We believe it would have had no other choice.

At the beginning of 1987, the consumer electronics industry would have recognized that the benefits of component video Y/C interfaces were far too valuable to ignore and thus they should be incorporated in the Decoder Interface. On the cable side, the emerging Impulse Pay Per View ("IPPV") promise and the related successful experiences cause the industry to seek the proper modifications in the Decoder Interface for accommodating IPPV. Again, a trip to the Commission would have been in order and the industries would have filed jointly for yet another extension of time. The cable industry would have provided testimonials for the record on overwhelming subscriber acceptance of the convenience and utility of the IPPV feature. The cable industry would have supplemented the record with valid and persuasive economic facts and arguments which would have shown that without the IPPV feature in the Decoder Interface, cable companies could not offer IPPV capability to all subscribers uniformly across the system. This would frustrate their IPPV marketing efforts and the financial viability of these decoders. Finally, the cable petitioners would have provided assurances that the data protocol they have devised to support the IPPV feature would not have to be changed in the future, as it uses only 16 out of 256 possible codes, allowing for future expansion. The consumer electronics industry would have supported cable's arguments and would have organized a Y/C interface video quality demonstrations for Commission staff, while providing market statistics showing the projected growth of Y/C interface equipped devices, raising concerns that Decoder Interfaces without such Y/C interface would quickly become obsolete.

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37. "The Descrambler Interface, A Progress Report" by E. S. Kohn, in *NCTA Technical Papers, 32nd Annual NCTA Convention,* Houston, TX, June 12-15, 1983. pp 321-324. - A copy of this Decoder Interface outline is attached to Appendix A.

Faced with this correctly characterized prospect of a Decoder Interface at grave economic risk, would the Commission have granted this second extension of time for the introduction of the Decoder Interface? What would have been the public benefits in denying the Joint Petitioners' request? - Preventing another delay in a slow introduction of a Decoder Interfaces that ultimately might not be well received by the public or by cable operators. We believe the Commission would have perceived a lower risk to the public interest by granting the extension of time.

The important message in this hypothetical analysis, is that industry engineering development efforts such as those required in establishing digital transmission formats and the subsequent interface specifications cannot be accelerated by regulatory fiats.

APPENDIX C

CANADIAN REGULATIONS FOR RF INTERFACE SPECIFICATIONS OF CABLE COMPATIBLE TELEVISION RECEIVERS.

Government of Canada
Department of Communications

Gouvernement du Canada
Ministère des Communications

TB – 3

TECHNICAL BULLETIN

CABLE COMPATIBLE TELEVISION RECEIVER MEASUREMENT METHODS

RELEASE DATE: JUNE 1, 1982

TELECOMMUNICATION REGULATORY SERVICE

BT – 3

BULLETIN TECHNIQUE

MÉTHODES DE MESURE DES PARAMÈTRES DES TÉLÉVISEURS CÂBLOCOMPATIBLES

PUBLICATION: 1er JUIN 1982

SERVICE DE LA RÉGLEMENTATION DES TÉLÉCOMMUNICATIONS

CABLE COMPATIBLE TELEVISION RECEIVER MEASUREMENT METHODS

Effective July 1, 1979, the Minister issued new regulations governing the sale of broadcasting receiving apparatus. These regulations identify a number of parameters in order to ensure compatibility with the radio environment and cable TV systems. On this subject, Section 19 of the General Radio Regulations Part I stipulates that:

> "Before offering for sale for use in Canada any radio apparatus of the class described in subsection 18(1), the manufacturer or importer shall ensure that the apparatus or a production sample or other representative unit of that type of apparatus is tested in accordance with a procedure approved by the Minister to determine whether or not it conforms to the applicable technical requirements established by the General Radio Regulations, Part II."

Throughout the intervening period, the Department has reviewed and accepted test methods submitted by manufacturers on a case-by-case basis to ensure compliance with the technical requirements of the Regulations. The Department, up until now, had not formally approved any particular measurement method.

The measurement methods presented in this technical bulletin are those presently used by the Department in ascertaining compliance with the General Radio Regulations. This bulletin is not intended to serve as a complete engineering standard and may be subject to future revisions.

The methods described permit a certain flexibility in the measurement of parameters, available test equipment and the elimination of some of the ambiguities encountered in past reports.

It should be emphasized that the Department will accept other methods provided they are fully documented and that their results coincide with the methods described herein. Manufacturers and other interested parties are invited to submit suggestions on alternate methods to:

The Director,
Broadcasting Regulations Branch
Telecommunication Regulatory Service
Department of Communications
300 Slater Street
Ottawa, Ontario
K1A 0C8

Manufacturers are reminded that final responsibility for compliance with Part II of the General Radio Regulations rests with them, and that the measurement methods described herein are provided as guidelines only.

Dr. John deMercado
Director General
Telecommunication Regulatory
Service

Tuning - Offset Capability

Equipment Required

Spectrum analyser or frequency counter (50 - 1000 MHz)

The minimum accuracy of the frequency measuring device shall be within 50 kHz.

Method

(1) The receiver's 75 ohm input is connected to the spectrum analyser (via a suitable matching network if required).

(2) Ensure that the receiver is operating normally and that the AFT (or AFC) if provided, is disabled.

(3) The receiver is tuned to channel 2 and the fine tuning frequency range of the local oscillator determined. In borderline cases, a reading of increased accuracy may be obtained through the use of a frequency counter (and amplifier if required).

(4) The above measurements are repeated for an adequate number of channels to ensure that the measurements are significant.

Limits

General Radio Regulations, Part II states the following:

> "133(a) when the apparatus is adjusted to receive signals from a broadcasting receiving undertaking, it shall be equipped and have characteristics as follows:
>
> > (ii) the fine tuning control or automatic frequency control shall provide sufficient adjustment of the apparatus over a range of frequencies to ensure
> >
> > > (A) for the very high frequency channels, reception of input signals whose visual carrier frequencies are offset by up to ± 0.55 MHz from their nominal visual carrier frequencies, and
> > >
> > > (B) for the mid-band channels and super-band channels, reception of input signals whose visual carrier frequencies are offset by up to -1.31 MHz from their nominal visual carrier frequencies."

Noise Figure

The method described herein presents revised excerpts from "FCC OST Bulletin 50 - Measurement of UHF Noise Figures of TV Receivers" as applicable to cable compatible television receiver noise figure measurements.

Equipment Required

Solid state noise source (with power supply)

Automatic noise figure indicator or high sensitivity tuneable voltmeter (selection dependent on sensitivity required)

The measuring devices shall have a bandwidth of at least 1 MHz

Method

(1) The receiver to be tested and the equipment associated with the measurements of noise figures are placed in a shielded room or other environment with levels of radio frequency energy low enough to minimize effects on the measurements.

(2) Before testing, the television receiver and noise figure test equipment are subjected to a warm-up period of sufficient time for stabilization of factors which could affect the measurements. The supply for line-operated receivers is required to be 120V $\pm$ 5%, 60 Hz or as specified; that for battery-operated receivers is the voltage specified.

(3) The TV receiver noise figure is preferably measured by coaxially connecting an automatic noise figure indicating system to the tuner output. If this connection is not feasible the noise output is obtained through the use of a small loop, or other suitable probe, coupled to one of the intermediate frequency amplifier stages. The stage chosen is that which yields the adequate noise output without disturbing shielding or other circuit elements. In the event that this, too, is not a workable approach, an appropriate low capacitance probe is used instead of the loop. A low noise preamplifier is used between the noise output from the receiver and the input of the indicating instrument in order to obtain a sufficient level, if necessary.

(4) A solid state noise source is connected to the receiver's 75 ohm input (via a suitable matching network if required). Particular care is taken that the signal path from the receiver's external input to its tuner is not disturbed.

(5) Automatic gain control bias, preceding the noise output measurement point, is maintained at the level existing when there is no input signal with the receiver's 75 ohm input terminated in its nominal impedance. The receiver is otherwise operated so that the noise figure data are actually those inherent to it.

(6) An automatic noise figure indicator should be used in conjunction with the noise source (companion units) to determine the noise figure of the television receiver. The center frequency of the television receiver's nominal intermediate frequency band at the measurement point is used as the center frequency of the automatic noise figure indicator to which the receiver's noise output is connected.

(7) Local oscillator frequencies are adjusted to within $\pm$ 0.55 MHz of the desired oscillator frequencies for VHF and within the 0 to -1.31 MHz range for midband and superband.

(8) It must be ascertained that the noise figure contribution of the IF amplifier following the measurement point does not exceed 0.25 dB. This can be done by application of the equation

$$\Delta F = 10 \log \left[1 + \frac{F_2 - 1}{F_1 \quad G_1} \right]$$

where ΔF = noise figure contribution of the IF amplifier following the measurement point in dB,

F_2 = noise figure of that IF amplifier as a power ratio,

F_1 = noise figure from receiver antenna input terminals to measurement point as a power ratio, and

G_1 = gain of circuit from receiver antenna input terminals to measurement point as a power gain.

Factor values in this equation may be calculated design characteristics or measured values. Resulting ΔF values exceeding 0.25 dB must be added to the value obtained at the measurement point for data submitted for certification. If ΔF does not exceed 0.25 dB, it may be neglected in the submitted noise figure data.

(9) Noise figure data in dB are to be reported as read from the noise figure indicating instrument. The only permissible correction factor is the impedance transformation loss. The required ΔF contribution must be given if they are part of the final submitted noise figure values.

(10) The above measurements are repeated for an adequate number of channels to ensure that the measurements are significant.

Limits

General Radio Regulations, Part II states the following:

"132(a) the noise figure for the radio apparatus shall,

(i) for channel numbers 2 to 13, not exceed 10 dB, and

(ii) for channel numbers 14 to 83, shall,

(A) if manufactured in or imported into Canada on or before October 1, 1981, not exceed 18 dB,

(B) if manufactured in or imported into Canada after October 1, 1981, and before October 2, 1984, not exceed 14 dB, or

(C) if manufactured in or imported into Canada after October 1, 1984, not exceed 12 dB,

"133(a) when the apparatus is adjusted to receive signals from a broadcasting receiving undertaking, it shall be equipped and have characteristics as follows:

(iii) the noise figure for any channel shall not exceed 10 dB except that, where the circuitry or configuration of the apparatus involves a double conversion of input signals, the noise figure may exceed 10 dB but shall not exceed 13 dB.

(b) when the apparatus is adjusted to receive signals from a broadcasting transmitting undertaking it shall conform to the requirements set out in section 132 except that the noise figure for channel numbers 2 to 13 shall not exceed 10 dB unless the circuitry or configuration of the apparatus involves a double conversion of input signals in which case the noise figure may exceed 10 dB but shall not exceed 13 dB."

Co-Channel Immunity

Equipment Required

Field strength meter

Adjustable dipole with frequency measuring ruler

RF amplifier

RF attenuator

Spectrum analyzer (50 - 250 MHz)

VHF multichannel antennas (2)

Multichannel RF generator (VHF channels 2 - 13) (optional)

Method

(1) A VHF multichannel receive antenna is placed in an environment permitting reception of off-air broadcast signals.

(2) The signal from the antenna is input to a broadband RF amplifier.

(3) The amplifier output signal is connected to the second VHF multichannel antenna in order to permit re-radiation of the broadcast signal.

(4) Utilizing a field strength meter and adjustable dipole, a 100 mV/m field is located at a distance of 5 - 10 meters from the re-radiation antenna. The antenna positions may have to be varied in order to prevent possible oscillations between re-radiation and pick-up antennas. The required field may be achieved by adjustment of the amplifier output level. (The F.S.M. reading is converted to mV/m by using the antenna correction factor for the corresponding frequency of the channel under investigation).

(5) The receiver under test is placed in the 100 mV/m field such that the antenna panel occupies the field. (The receiver must not block the antenna panel from the transmitted signal.)

(6) The feed from the multichannel RF generator or local cable system is connected to the spectrum analyzer (via a suitable matching network if required).

(7) The spectrum analyzer is tuned to the frequency of interest and the amount of attenuation required to produce levels of -20 dBmV and 0 dBmV determined.

(8) Ensure that the receiver is operating normally and that all customer switches and controls are adjusted for cable reception and normal viewing for the channel of interest.

(9) The signal feed is then connected to the receiver's 75 ohm input by means of a coaxial cable whose length equals an odd multiple of $\lambda/2$ for the channel under test.

(10) With an input signal level of -20 dBmV, an attempt should be made to identify the non-coincident sync interference. This will enable the tester to concentrate on the video interference only. (If observation of the non-coincident sync information is preferable, the input signal level may be adjusted to -37 dBmV).

(11) The input signal level is then increased to 0 dBmV and the receiver's picture display observed for any evidence of co-channel synchronous interference (-17 dBmV for non-synchronous interference)

(12) The above measurements are repeated for an adequate number of channels to ensure that the measurements are significant.

Limits

General Radio Regulations, Part II states the following:

> "133(a) when the apparatus is adjusted to receive signals from a broadcasting receiving undertaking, it shall be equipped and have characteristics as follows:
>
> > (iv) the apparatus shall be so shielded that there is no noticeable evidence of interference when
> >
> > > (A) the apparatus is in the field of a co-channel synchronous television signal having a measured field strength of 100 millivolts per metre, and
> > >
> > > (B) the signal level of the desired input signal is adjusted to 1 millivolt (0 dBmV) at the input terminals of the apparatus."

Signal Overload

Equipment Required

Spectrum analyser (50 - 1,000 MHz)

RF attenuator

RF amplifier

Multichannel RF generator or signal available from local cable system (minimum capability of VHF channels 2-13, and three adjacent mid band channels).

Method

(1) The feed from the multichannel RF generator or local cable system is connected to the spectrum analyser (via a suitable matching network if required).

(2) The spectrum analyser is tuned to channel 2 and the input signal amplified (if required) to produce a level of 14 dBmV at the frequency of interest.

(3) The adjusted signal feed is then connected to the receiver's 75 ohm input and the receiver tuned to channel 2.

(4) Ensure that the receiver is operating normally and that all customer switches and controls are adjusted for cable reception and normal viewing.

(5) The receiver's picture display is then observed for any evidence of overload.

(6) The above procedure is repeated for all available channels.

Limits

General Radio Regulations, Part II states the following:

> "133(a) when the apparatus is adjusted to receive signals from a broadcasting receiving undertaking, it shall be equipped and have characteristics as follows:
>
> (vi) there shall be no overloading of the apparatus at any signal level below 5 millivolts (14 dBmV)."

Image Rejection

Equipment Required

VHF signal generator

Oscilloscope or Spectrum analyzer (optional)

RF attenuator

Method

(1) The feed from the VHF signal generator is connected to the receiver's 75 ohm input via the RF attenuator.

(2) The signal input level is reduced so as to operate the AGC in a maximum gain mode.

(3) The IF level is then measured at the IF detector point.

(4) The VHF signal generator is then adjusted to the image frequency and fine tuned to maximize signal at the IF detector point.

(5) The generator output level is adjusted so as to match the IF detector point amplitude level measured in (3) above.

(6) The image rejection is then determined from the difference in the generator output levels of (2) and (5) above.

(7) The above procedure is applied to all channels whose image frequency falls below 300 MHz.

Limits

General Radio Regulations, Part II states the following:

"133(a) when the apparatus is adjusted to receive signals from a broadcasting receiving undertaking, it shall be equipped and have characteristics as follows:

> (vii) the image rejection shall be at least 60 dB for any image frequency below 300 MHz."

Internally Generated Interference

Equipment Required

Spectrum analyser (5 - 1,000 MHz)

Method

(1) The receiver under test and the equipment associated with the measurements are placed in an environment with levels of radio frequency sufficiently low so as to preclude any effects on the measurements.

(2) Ensure that the receiver is operating normally and that all customer switches and controls are adjusted for cable reception and normal viewing.

(3) The receiver's 75 ohm input is connected to the spectrum analyser (via a suitable matching network if required).

(4) The receiver is tuned to channel 2 and the spectrum searched for any internally generated signals.

(5) The above measurements are repeated for all channels.

Limits

General Radio Regulations, Part II states the following:

"133(a) when the apparatus is adjusted to receive signals from a broadcasting receiving undertaking, it shall be equipped and have characteristics as follows

(viii) the level of any local oscillator signal and of any signal of an undesired or spurious nature, generated within the apparatus and arriving at the cable input terminals of the apparatus.

(A) in the frequency range above 5 MHz and below 54 MHz, shall not exceed -50 dBmV

(B) in the frequency range from 54 MHz to 300 MHz, shall not exceed -26 dBmV, and

(B) in the frequency range above 300 MHz and below 1000 MHz, shall not exceed -10 dBmV."

APPENDIX D

Press Release Jerrold GI **General Instrument**

General Instrument Corporation
Jerrold Communications Division
2200 Byberry Road
Hatboro, Pennsylvania 19040

Contact:
Jim Barthold
Tel 215 956 6448

Ron Katznelson, MCSI
619-597-4004

MCSI to demonstrate digital broadband descrambling with Jerrold/General Instrument at NCTA Show

SAN FRANCISCO (June 7, 1993) ... Multichannel Communication Sciences, Inc. (MCSI) will give the first public demonstration of its Digital Broadband Descrambling (DBD) technology in the Jerrold exhibit at this year's National Cable Television Association show here this week.

The DBD technology is based on novel proprietary digital signal processing techniques developed by MCSI and is the first demonstrated method for simultaneously descrambling many individually selected cable TV channels at the subscriber location. At the same time it passes through other channels to the subscriber either unaffected or with further denial imposed for unauthorized channels. DBD access control devices can be installed at the subscriber's premises point of entry (such as the side of the home), the pole or pedestal or even by indoor set-back deployment.

Using DBD cable subscribers receive all authorized channels simultaneously in the clear, restoring the features of TVs and VCRs. Furthermore, the DBD devices pass into the home all other unprocessed channels, including digital compression signals, thereby allowing compatibility with future digital transmission said MCSI President Ron Katznelson.

Jerrold President Hal Krisbergh said MCSI's technology has some "interesting implications in light of increased demands for consumer friendliness."

One important aspect is that MCSI is offering an access technology, overcoming many of the shortcomings of interdiction. Because MCSI's signal does not travel in the clear, it is more secure than interdiction.

- more -

"At Jerrold we are always looking at new technologies that have the potential to improve the ease of using cable television," said Krisbergh. "By showing it in our booth, we hope to draw the attention of the entire cable industry to it and allow them to see yet another potential solution."

Katznelson said that the ability to show the technology in the Jerrold booth will give his company exposure to potential users of DBD.

"Digital Broadband Descrambling products will provide cable operators with sustainable differentiation over competitive Direct Broadcast Satellite (DBS) due to DBS' inherent reliance on a 'single channel at a time' set-top decoders and the inability to provide subscribers full consumer electronics compatibility or low-cost additional TV outlet service," said Katznelson, in offering yet another strength of the technology.

"Also," he concluded, "the addressable channel denial features inherent in DBD will allow system operators to implement program tiering into one or more expanded basic services without incurring the expenses associated with scrambling these channels."

MCSI is a San Diego, California based high technology company specializing in the development of broadband digital signal processing techniques for cable access control and for fiber optic transmission of television signals.

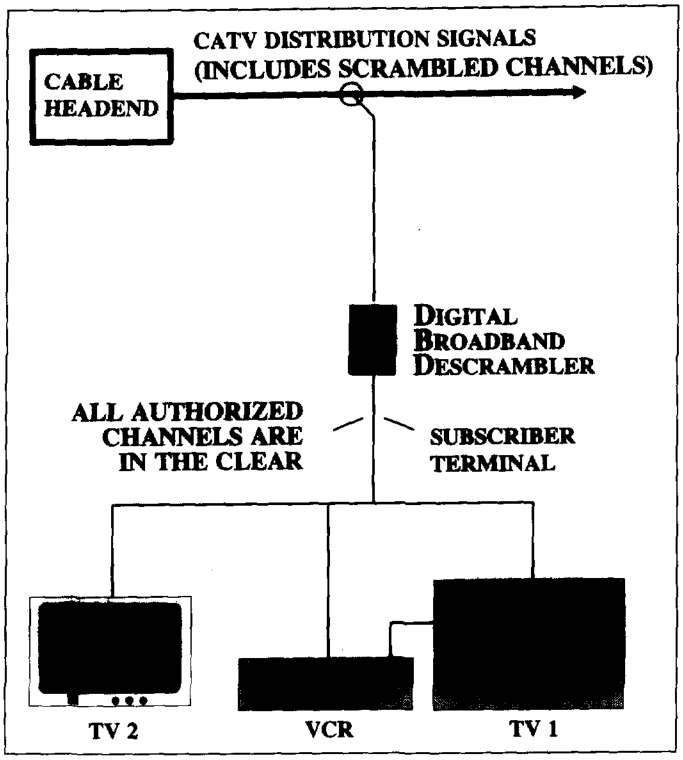
General Instrument Corporation is a world leader in broadband transmission, distribution and access control technologies for cable, satellite and terrestrial broadcasting applications, as well as in discrete power rectifying components.

###

DIGITAL BROADBAND DESCRAMBLING

A SUBSCRIBER FRIENDLY TECHNOLOGY FOR THE 90'S AND BEYOND

- **All authorized channels supplied to subscriber terminals simultaneously and in-the-clear.**
- **Compatible with the most widely used cable scrambling formats and allows for a transition to enhanced security scrambling mode.**
- **Addressable local denial of selected expanded basic channels allows cost-effective tiering without having to scramble these channels.**
- **Simultaneously clear broadband service has been proven to generate significant pay lift.**
- **Provides cable operators with a key sustainable advantage over competitive multi-channel video providers who must rely on "single-channel-at-a-time" decoders.**
- **Coexistence compatibility with future digital transmission systems.**



Finally, there is a *cost-effective* technology that enables cable system operators to provide subscribers with a truly "subscriber friendly" signal security system, while increasing revenues and reducing operating costs associated with set-top descrambler churn. It is called *Digital Broadband Descrambling* ("DBD"), a proprietary digital signal processing based technology developed by Multichannel Communication Sciences, Inc. ("MCSI"). DBD products can simultaneously descramble a large number of scrambled TV signals, while at the same time leaving other channels unaltered or performing on-channel denial processing to securely deny these channels.

Unlike existing "single-channel-at-a-time" descrambling technologies, the DBD technology simultaneously provides subscribers with all of their authorized channels "in the clear", thereby enabling them to enjoy all the features of their cable ready TV's and VCR's.

All this is accomplished in a manner that is compatible with most of today's sync suppression scrambling formats, allowing cable operators who operate scrambled addressable systems to deploy DBD products through an economically graceful migration.

This "simultaneously clear addressable broadband" approach provides cable service to subscribers in a manner that is fully responsive to the Cable Act of 1992, while enabling operators to reduce service call costs associated with home wiring, TV tuning and set-top descrambler churn. A related proven benefit is the resulting Pay services subscription lift.

In addition, DBD devices can be employed to implement the tiering of Expanded Basic services without tier buy-through restrictions. Since DBD devices pass through all unprocessed channels to the subscriber unaltered, it can coexist with all future digital transmission schemes while eliminating their incremental costs required to receive scrambled analog TV signals.

Cable operators employing DBD technology will have a strong service differentiation over competitive video providers who will be unable to provide a consumer friendly interface with "set-top-less" broadband service to the home.

Digital Broadband Descrambling.
MCSI's proprietary DBD technology is based on a wide-band digital spectral processing system which provides for separate and independent signal processing functions in each 6 MHz CATV channel within preselected channel groups. Using digital broadband RF signal processing techniques, DBD devices simultaneously descramble a large number of channels, while at the same time process other selected channels to deny access to signals transmitted in-the-clear, or even further deny access to selected scrambled channels. While this "on-channel" processing is being done, all other unprocessed channels on the cable system are passed through to the subscriber unaltered by the DBD hardware.

The result is that the entire spectrum of channels is available to the subscriber, with authorized channels descrambled on-channel, and unauthorized channels passed through in their original scrambled form, or even further processed in the DBD subscriber unit to affect further denial beyond normal scrambling, i.e., to provide additional security. This additional denial feature also provides the operator with the ability to deny otherwise clear signals for cost-effective tiering of Expanded Basic channels without having to scramble these channels.

Compatible with Existing Scrambling Systems.
The MCSI descrambling technology can be implemented to descramble signals scrambled with either baseband sync suppression or the RF sync suppression scrambling methods. This compatibility allows for phased, cost-effective and backward-compatible migration from today's single channel set-top descramblers to multichannel Digital Broadband Descramblers.

Transition to Enhanced Scrambling.
Because of its inter-operability with set-top converter/descramblers, DBD technology can be phased-in without initial changes to the existing headend scramblers, controllers or their software. Since some of today's sync suppression cable scrambling schemes have been compromised by pirate decoders, DBD technology offers operators a chance to migrate to a new enhanced security multichannel video scrambling method. The MCSI method, called Random Video Folding, provides secure video inversion that is randomly dependent on video content.

Tiering.
The DBD device's ability to deny access to selected clear channesl allows an operator to protect multiple Expanded Basic tiers without the need to scramble those signals at the headend, and without having to equip the subscribers to highly penetrated Expanded Basic tiers with a descrambler. Hence, MCSI's DBD technology offers operators a much more attractive and flexible alternative for simultaneously clear service than cost intensive approaches such as Interdiction, or inflexible approaches such as traps.

Number of Processed Channels.
Because DBD signal processing functions can be implemented over the entire CATV channel range, the incremental cost for adding more controlled channels is quite low. With custom VLSI chips, the number of controlled channels can economically reach 72 or more.

Video and Audio Quality.
Broadband Descramblers do not employ single channel filtering or remodulation and therefore introduce virtually no artifacts or distortions in the video or the audio signals of descrambled and non-blocked channels. Therefore, the video and audio quality is significantly improved over current set-top devices. Also, functions such as MTS stereo are received without buzz or loss of performance introduced by today's set-top descramblers.

Configuration and Location.
The DBD devices (either single subscriber or MDU configurations) may be installed on the pole, in a pedestal, on the side of the home, or any other point of entry. Indoor single subscriber devices are also feasible. In addition to selective channel access control, each subscriber device is equipped with an addressable control enabling a full service disconnect function.

Projected Cost.
The average per subscriber cost of DBD devices is projected to be comparable to that using addressable set top devices.

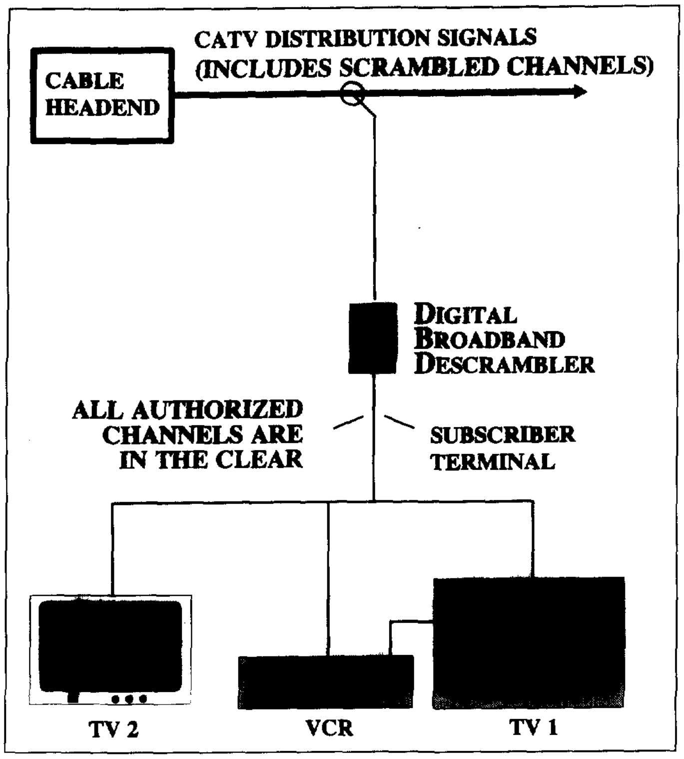
MCSI • 5910 Pacific Center Blvd. Suite 150, San Diego, CA 92121 • Tel: (619) 587-6777

~~3550 Dunhill Street, San Diego, CA 92121 • Tel: (619) 597-4004~~

DIGITAL BROADBAND DESCRAMBLING

A SUBSCRIBER FRIENDLY TECHNOLOGY FOR THE 90'S AND BEYOND

- **All authorized channels supplied to subscriber terminals simultaneously and in-the-clear.**
- **Compatible with the most widely used cable scrambling formats and allows for a transition to enhanced security scrambling mode.**
- **Addressable local denial of selected expanded basic channels allows cost-effective tiering without having to scramble these channels.**
- **Simultaneously clear broadband service has been proven to generate significant pay lift.**
- **Provides cable operators with a key sustainable advantage over competitive multi-channel video providers who must rely on "single-channel-at-a-time" decoders.**
- **Coexistence compatibility with future digital transmission systems.**



Finally, there is a *cost-effective* technology that enables cable system operators to provide subscribers with a truly "subscriber friendly" signal security system, while increasing revenues and reducing operating costs associated with set-top descrambler churn. It is called *Digital Broadband Descrambling* ("DBD"), a proprietary digital signal processing based technology developed by Multichannel Communication Sciences, Inc. ("MCSI"). DBD products can simultaneously descramble a large number of scrambled TV signals, while at the same time leaving other channels unaltered or performing on-channel denial processing to securely deny these channels.

Unlike existing "single-channel-at-a-time" descrambling technologies, the DBD technology simultaneously provides subscribers with all of their authorized channels "in the clear", thereby enabling them to enjoy all the features of their cable ready TV's and VCR's.

All this is accomplished in a manner that is compatible with most of today's sync suppression scrambling formats, allowing cable operators who operate scrambled addressable systems to deploy DBD products through an economically graceful migration.

This "simultaneously clear addressable broadband" approach provides cable service to subscribers in a manner that is fully responsive to the Cable Act of 1992, while enabling operators to reduce service call costs associated with home wiring, TV tuning and set-top descrambler churn. A related proven benefit is the resulting Pay services subscription lift.

In addition, DBD devices can be employed to implement the tiering of Expanded Basic services without tier buy-through restrictions. Since DBD devices pass through all unprocessed channels to the subscriber unaltered, it can coexist with all future digital transmission schemes while eliminating their incremental costs required to receive scrambled analog TV signals.

Cable operators employing DBD technology will have a strong service differentiation over competitive video providers who will be unable to provide a consumer friendly interface with "set-top-less" broadband service to the home.

Digital Broadband Descrambling.

MCSI's proprietary DBD technology is based on a wide-band digital spectral processing system which provides for separate and independent signal processing functions in each 6 MHz CATV channel within preselected channel groups. Using digital broadband RF signal processing techniques, DBD devices simultaneously descramble a large number of channels, while at the same time process other selected channels to deny access to signals transmitted in-the-clear, or even further deny access to selected scrambled channels. While this "on-channel" processing is being done, all other unprocessed channels on the cable system are passed through to the subscriber unaltered by the DBD hardware.

The result is that the entire spectrum of channels is available to the subscriber, with authorized channels descrambled on-channel, and unauthorized channels passed through in their original scrambled form, or even further processed in the DBD subscriber unit to affect further denial beyond normal scrambling, i.e., to provide additional security. This additional denial feature also provides the operator with the ability to deny otherwise clear signals for cost-effective tiering of Expanded Basic channels without having to scramble these channels.

Compatible with Existing Scrambling Systems.

The MCSI descrambling technology can be implemented to descramble signals scrambled with either baseband sync suppression or the RF sync suppression scrambling methods. This compatibility allows for phased, cost-effective and backward-compatible migration from today's single channel set-top descramblers to multichannel Digital Broadband Descramblers.

Transition to Enhanced Scrambling.

Because of its inter-operability with set-top converter/descramblers, DBD technology can be phased-in without initial changes to the existing headend scramblers, controllers or their software. Since some of today's sync suppression cable scrambling schemes have been compromised by pirate decoders, DBD technology offers operators a chance to migrate to a new enhanced security multichannel video scrambling method. The MCSI method, called Random Video Folding, provides secure video inversion that is randomly dependent on video content.

Tiering.

The DBD device's ability to deny access to selected clear channesl allows an operator to protect multiple Expanded Basic tiers without the need to scramble those signals at the headend, and without having to equip the subscribers to highly penetrated Expanded Basic tiers with a descrambler. Hence, MCSI's DBD technology offers operators a much more attractive and flexible alternative for simultaneously clear service than cost intensive approaches such as Interdiction, or inflexible approaches such as traps.

Number of Processed Channels.

Because DBD signal processing functions can be implemented over the entire CATV channel range, the incremental cost for adding more controlled channels is quite low. With custom VLSI chips, the number of controlled channels can economically reach 72 or more.

Video and Audio Quality.

Broadband Descramblers do not employ single channel filtering or remodulation and therefore introduce virtually no artifacts or distortions in the video or the audio signals of descrambled and non-blocked channels. Therefore, the video and audio quality is significantly improved over current set-top devices. Also, functions such as MTS stereo are received without buzz or loss of performance introduced by today's set-top descramblers.

Configuration and Location.

The DBD devices (either single subscriber or MDU configurations) may be installed on the pole, in a pedestal, on the side of the home, or any other point of entry. Indoor single subscriber devices are also feasible. In addition to selective channel access control, each subscriber device is equipped with an addressable control enabling a full service disconnect function.

Projected Cost.

The average per subscriber cost of DBD devices is projected to be comparable to that using addressable set top devices.

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